A Comparison of the Effect of Different Bicycle Helmet Laws in 3 New York City Suburbs

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ABSTRACT

Objectives. This study was conducted to evaluate the effectiveness of 3 different bicycle helmet laws.

Methods. A direct observational study of nearly 1000 cyclists at 20 matched sites in each of 3 contiguous counties—Rockland and Westchester in New York and Fairfield in Connecticut—was carried out. Rockland's bicycle helmet law requires approved helmets for all cyclists regardless of age; Westchester's, by state law, requires cyclists younger than 14 years to wear helmets; and Fairfield's, also by state law, requires cyclists younger than 12 years to wear helmets when riding on highways.

Results. Rockland cyclists had the highest helmet use rate (35%), followed by Westchester (24%) and Fairfield (14%) cyclists. As a subgroup, teenagers used helmets least, a trend that was seen in all 3 counties.

Conclusions. Our study suggests a positive effect of bicycle helmet legislation with no age limitation. (*Am J Public Health.* 1999;89:1736–1738)

Bicycle crashes cause approximately 1000 deaths each year; two thirds of these deaths result from head injury.[1] Bicycle helmets reduce the risk of head injury from a bicycle crash by 85%.[2]

On October 1, 1992, Rockland County, NY, became the first county in the nation with a law making bicycle helmets mandatory for all bicyclists regardless of age. Effective October 1, 1993, a Connecticut state law required cyclists younger than 12 years to use helmets on "the traveled portion of any highway."[3] On June 1, 1994, a New York state law mandating bicycle helmet use for cyclists younger than 14 years went into effect. The Rockland and New York State laws each carry a $50 fine, which is waived for the first offense if a helmet is purchased. The Connecticut law carries no fine.

Numerous researchers have documented their frustration with educational efforts alone as a method for increasing the use of bicycle helmets. In a study at the Children's Hospital of Ontario, parents of children who had sustained a bicycle injury still were not motivated to buy their children helmets after they were directly counseled about helmet use, including follow-up phone counseling.[4]

Dannenberg et al.[5] surveyed students in Howard County, Md, where a mandatory bicycle helmet law was passed in 1990 for cyclists younger than 16 years. The survey showed an increase in helmet use, from 11% to 37%, after the law and accompanying educational campaign went into effect. In neighboring Montgomery County, helmet use rose from 8% to 13% with an educational campaign only. Cote et al. reported similar results in a direct observational study.[6]

A communitywide promotional campaign in Seattle[7] increased bicycle helmet use from 5% in 1987 to approximately 40% in 1992. Although this increase is remarkable, the campaign was quite extensive in its coverage and depth of community participation. This included television, radio, and print media advertisements; events such as bicycle rodeos; endorsements from prominent sports figures; and reduced helmet prices.[8] Yet the Seattle researchers concluded, "The gradual plateauing of the effect of our educational program in the past two years indicates that legislation may be necessary to achieve helmet use by the majority of children riding bicycles."[7(p568)]

We were presented with a unique opportunity to study the effect of bicycle helmet legislation. Three contiguous counties north of New York City—Rockland and Westchester in New York and Fairfield in Connecticut—have equal access to metropolitan and national media, equal access to medical care (and anticipatory guidance), and similar populations, but they have 3 different bicycle helmet laws.

The Department of Pediatrics at Nyack Hospital performed several surveys and direct observational studies in Rockland County during the summers of 1989, 1990, 1991, and 1994. Helmet use among Rockland bicyclists before helmet legislation was initiated in 1992 was approximately 12%. The 1994 survey found that 74% of parents stated that their children always used helmets when they rode bicycles, while direct observation found that only 36% of children actually wore them (D.R.P., unpublished data, 1994). For this reason, we chose to base the current study exclusively on direct observation of bicycle riders.

Methods

Sampling and Data Collection

Sampling of bicycle riders was conducted during June and July 1995. Sites were selected throughout the 3 counties to obtain as representative a sample of each county as possible. Care was taken to sample from a variety

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of socioeconomic and ethnic areas and to maintain a distribution of sites that was equal among the 3 counties. Other site parameters that were monitored were day of the week (weekend vs weekday), time of day, and posted motor vehicle speed limits. Within each site, we attempted to obtain at least 20 unique observations; this minimum was obtained in more than 90% of the sites (47 of 51).

Medical and premedical students gathered the prevalence data in each of the counties. Before collecting data, the students practiced assessing ages of individuals in a community setting to ensure the reliable reporting of ages. For collection of helmet use data, the students traveled to each site during specified times and recorded site characteristics; the total number of bicycle riders; the age, sex, and ethnicity of riders; and helmet use. All observers rotated among sites in each county.

To assess the reliability of reporting on age, we used a method described by Rosner[9] and computed intraclass correlations for the 8 raters, which indicated that all of the investigators estimated age well and equally. Mean differences between each rater's estimation of age and the actual age were also evaluated by a paired *t* test. In estimating the ages of adults, the reliability of raters was fair to good, with intraclass correlation coefficients ranging from 0.68 to 0.76. Most raters significantly underestimated the age of adults, by about 2 years. For the estimates of ages of children and adolescents, raters performed in the good to excellent range, with intraclass correlation coefficients of 0.72 to 0.85.

Statistical Methodology

Differences among counties in demographic characteristics and site properties were assessed by the Pearson χ^2 test. Age differences among counties were assessed through a 1-way analysis of variance. For multivariate modeling of the differences among counties in the prevalence of helmet use, we performed logistic regression, adjusting for demographic and site characteristics. For these analyses, the model included age, sex, day of the week, road type, and county. Ethnicity was modeled with 2 indicator variables for Black, Hispanic, and White; the Asian category was excluded because of its small sample size. Road type was modeled with 2 indicator variables depending on whether the posted speed limit was below 35 miles per hour, above 35 miles per hour, or unposted. County was similarly represented, with 2 indicator variables representing the 3 counties. Since the logistic model generated prevalence odds ratios that might be difficult to interpret in cross-sectional studies, we converted the prevalence odds ratios to prevalence rate ratios with corresponding 95% confidence intervals, using a method suggested by Osborn and Cattaruzza.[10]

TABLE 1—Distribution of Selected Demographics and Study Characteristics by County

Characteristic	County		
	Rockland	Westchester	Fairfield
Bicyclists counted	974	782	857
Male (%)	713 (73.2)	622 (79.5)	651 (76)
Female (%)	261 (26.8)	160 (20.5)	206 (24)
Mean age, y (SD)	17.3 (11.7)	19.9 (12.1)	20.5 (11.8)
Ethnicity, n (%)			
Asian	22 (2)	17 (2)	18 (2)
Black	183 (18)	247 (32)	235 (27)
Hispanic	81 (8)	133 (17)	176 (20)
White	688 (71)	385 (49)	428 (50)
Weekday cyclists (%)	630 (65)	529 (68)	589 (69)
Weekend cyclists (%)	344 (35)	253 (32)	268 (31)
Road type, n (%)			
>35 mph	152 (16)	454 (58)	422 (49)
≤35 mph	628 (64)	180 (23)	216 (26)
Not posted	194 (20)	148 (19)	216 (25)
Helmet use, n (%)			
Yes	340 (35)	189 (24)	122 (14)
No	634 (65)	593 (76)	735 (86)

Note. mph = miles per hour.

Results

A total of 2615 observations from 51 sites were obtained during the study period. Each county constituted approximately one third of the total sample by number of observations and number of sites. The average age of riders was estimated to be 19.1 years, with a standard deviation of 11.5 years. There was a preponderance of male riders and White riders.

Table 1 compares sample characteristics among the 3 counties. Although in many instances the absolute differences in characteristics by county were small (e.g., age and sex), the large sample size rendered these statistically significant. Substantial differences in distributions did occur in race/ethnicity, road type, and helmet use. In Rockland County about 70% of the sample was White, whereas in Westchester and Fairfield counties only about 50% of the sample was White. Helmet use was highest in Rockland County (35%) and lowest in Fairfield County (14%).

The logistic regression analysis showed that differences in helmet use among counties remained after differences on demographic characteristics and other variables were accounted for (Table 2). With the prevalence of nonuse in Rockland County (i.e., 65.1%) serving as the reference, the prevalence rate ratio was 9% higher in Westchester County and 28% higher in Fairfield County. These ratios correspond to the adjusted prevalences of nonuse of 71.0% and 83.3%, respectively. We conducted a similar analysis for a subgroup of the sample 14 years or younger, controlling for sex, race, road type, and day of the week. Results were consistent with those reported above, showing a significant increase in nonuse by county (Table 3). With the prevalence rate of 62.9% in Rockland County serving as the reference category, the prevalence of nonuse in Westchester County was 17% higher (i.e., 73.6%) and the prevalence rate in Fairfield County was 34% higher (i.e., 84.3%).

Fairfield County has the most limited bicycle helmet law of the 3 counties, and it was found to have the lowest rate of helmet use among cyclists in each category. Westchester County has a more comprehensive law, and it was found to have nearly double Fairfield's rate of helmet use despite the fact that the Westchester law was passed a year later. Rockland County has the most comprehensive law, and it was found to have a rate of helmet use rate 2.5 times that of Fairfield County.

In all counties, teenage bicyclists wore helmets the least; however, Rockland teenagers were twice as likely as Westchester teenagers and 4 times as likely as Fairfield teenagers to wear helmets when riding bicycles (Rockland, 17%; Westchester, 8%; Fairfield, 4%).

TABLE 2—Logistic Regression Model Examining Risk of Nonuse of Helmets[a] (n = 2556)

County	Parameter Estimate	SE	Prevalence Rate Ratio[b]	95% CI[c]	P
Rockland	1.0	1.0			
Westchester	0.2815	0.1285	1.09	1.01, 1.18	.028
Fairfield	0.9821	0.1339	1.28	1.20, 1.37	.0001

Note. CI = confidence interval.
[a]Controlling for sex, race, and day of sampling.
[b]Computed with method described by Osborn and Cattaruzza.[10]
[c]Computed with test-based formula.

TABLE 3—Logistic Regression Model Examining Risk of Nonuse of Helmets[a] by Those 14 Years or Younger (n = 1193)

County	Parameter Estimate	SE	Prevalence Rate Ratio[b]	95% CI[c]	P
Rockland	1.0	1.0			
Westchester	0.4899	0.1842	1.17	1.04, 1.29	.002
Fairfield	1.128	0.1982	1.34	1.21, 1.47	.0001

Note. CI = confidence interval.
[a]Controlling for sex, race, and day of sampling.
[b]Computed by method described by Osborn and Cattaruzza.[10]
[c]Computed with test-based formula.

Discussion

The current study could not assess the extent to which educational campaigns promoting helmet use differed between the counties. No coordinated communitywide promotional campaigns approaching the scope or intensity of the Seattle campaign were conducted during or prior to our data collection period. While we did not assess smaller campaigns conducted in schools or local communities, it is unlikely that these limited efforts could account for the differences in county rates found in our results.

We feel that our study suggests a positive effect of bicycle helmet legislation with no age limitation. Further, we believe that bicycle safety promotion and education are enhanced by legislation and that an age cutoff is inappropriate. □

Contributors

D. R. Puder planned the study, supervised the students, and was the principal author. P. Visintainer provided the statistical analysis of the data. D. Spitzer and D. Casal helped analyze and write the paper.

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